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A basic study for application of ocean-bottom seismographs to the EEW system

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In the railway field of Japan, to ensure the safety of trains running in a certain area which strong shakings will attack during earthquakes, the earthquake early warning (EEW) system using estimated earthquake information has been installed. To issue the EEW as soon as possible for subduction zone earthquakes, we considered it is important to apply ocean-bottom seismographs (OBSs) to the EEW system and performed a basic investigation for the difference between seismic motions observed on the seafloor and those on the ground.

In this study, we used 213 seismic motion data observed by three OBSs of Ocean Bottom Cable System off Sanriku and 23796 data K-NET/KiK-net for 71 earthquakes.

By investigating the relationships between peak accelerations observed on the seafloor and those on the ground using the differences from estimated values by the attenuation relationships for PGA (Korenaga et al., 2012), we confirmed the values of peak accelerations on the seafloor are about 3 times larger than those on the ground on average. For several earthquakes, we compared Fourier spectrums of S-waves on the seafloor and those on the ground and verified that amplitudes on the seafloor are about 10 times larger than those on the ground in low frequency below 5Hz and, on the other hand, those on the seafloor is significantly lower than those on the ground in high frequency over 5Hz. It seems that the high-frequency components are amplified by the soft sediment on the seafloor.

Those results indicate the characteristics of seismic motions observed on the seafloor are largely different from those on the ground. Therefore, the site amplification the frequency characteristics on the seafloor must be considered for applying OBSs to the EEW system.

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Keywords: ocean-bottom seismograph (OBS), earthquake early warning (EEW), peak acceleration, off Sanriku